



## Dynamics of N<sub>2</sub>O production pathways analyzed by <sup>15</sup>N<sup>18</sup>O isotope labeling

Jensen, Marlene Mark; Ma, Chun; Lavik, Gaute; Smets, Barth F.; Thamdrup, Bo

*Publication date:*  
2017

*Document Version*  
Peer reviewed version

[Link back to DTU Orbit](#)

*Citation (APA):*

Jensen, M. M., Ma, C., Lavik, G., Smets, B. F., & Thamdrup, B. (2017). *Dynamics of N<sub>2</sub>O production pathways analyzed by <sup>15</sup>N<sup>18</sup>O isotope labeling*. Abstract from International workshop on marine geomicrobiology - A matter of energy, Sønderborg, Denmark.

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

# Dynamics of N<sub>2</sub>O production pathways analysed by <sup>15</sup>N/<sup>18</sup>O dual isotope labelling – data from a full-scale wastewater treatment plant

M. M. Jensen\*\*, C. Ma\*, G. Lavik\*\*\*, B. F. Smets\*\*, B. Thamdrup\*

\* Department of Biology, University of Southern Denmark (SDU), Odense, Denmark, chun@biology.sdu.dk; bot@biology.sdu.dk

\*\* Department of Environmental Engineering, Technical University of Denmark, Kongens Lyngby, Denmark, mmaj@env.dtu.dk; bfm@env.dtu.dk

\*\*\* Max Planck Institute for Marine Microbiology, Bremen, Germany, glavik@mpi-bremen.de

Nitrous oxide production associated with biological nitrogen transformations can contribute substantially to the CO<sub>2</sub> footprint of both man-made and natural systems, but the pathways and regulation of N<sub>2</sub>O production are poorly understood. We developed a <sup>15</sup>N/<sup>18</sup>O dual isotope labelling technique to distinguish and quantify these pathways in mixed communities. The use of <sup>18</sup>O-O<sub>2</sub> permits differentiation of hydroxylamine oxidation and nitrifier-denitrification driven N<sub>2</sub>O production by ammonium oxidizing bacteria. We analysed N<sub>2</sub>O production pathways during biological nitrogen removal at Lynetten wastewater treatment plant. Under anoxia, N<sub>2</sub>O accumulated due to denitrification, but N<sub>2</sub>O accumulation was ~3 and 1.7 times higher at 30 and 100 μM O<sub>2</sub>, respectively. Oxic N<sub>2</sub>O production was dominated by nitrifier-denitrification, reaching 73% of the total with the remainder due to hydroxylamine oxidation. Our results demonstrate three active pathways of N<sub>2</sub>O production, each with different environmental controls. The dual <sup>15</sup>N/<sup>18</sup>O isotope labelling approach can contribute to the development of strategies to minimise N<sub>2</sub>O emissions from man-made and natural systems.